

UMTS 900MHz Overview

March 2006

- Executive Summary
- Spectrum Update
- Drivers and Benefits
- Deployment Considerations
- Industry Support

- *UMTS900 combines superior performance of UMTS with coverage benefits of 900MHz spectrum*
- *UMTS900 provides excellent coverage in rural areas*
- *UMTS900 improves in-door coverage and augments capacity in urban areas*
- *UMTS900 can co-exist with GSM900*
- *UMTS900 has broad based industry support*

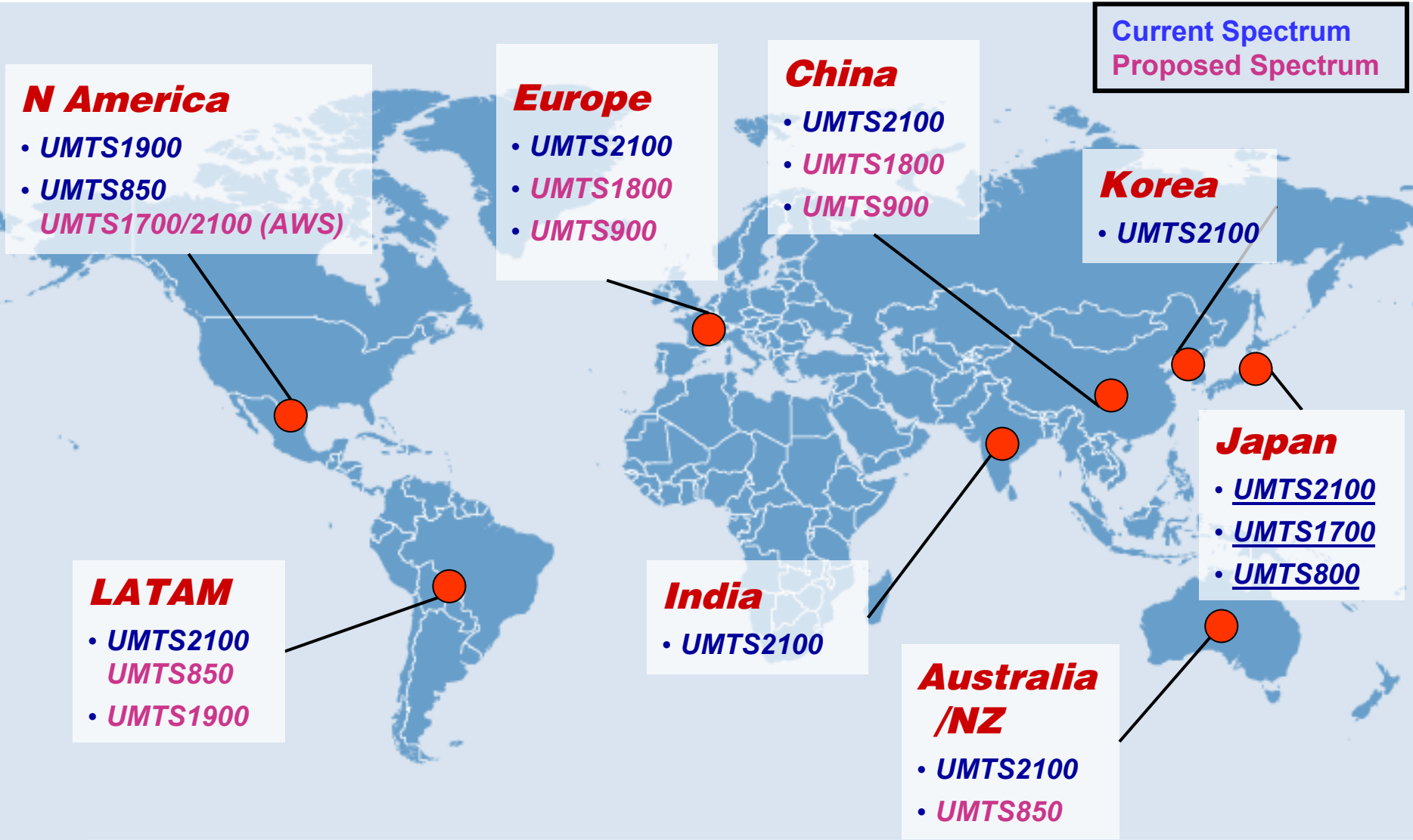
3GPP Defined UMTS Frequency Bands

UMTS900

DESIGNATED SPECTRUM	3GPP BAND CLASS	800	900	1000
UMTS850	BC5		824–849 <u>Uplink</u> 869–894 <u>Downlink</u>	
UMTS800	BC6		830–840 <u>Uplink</u> 875–885 <u>Downlink</u>	
UMTS900	BC8		880–915 <u>Uplink</u> 925–960 <u>Downlink</u>	

DESIGNATED SPECTRUM	3GPP BAND CLASS	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600
UMTS2100	BC1			1920–1980 <u>Uplink</u>		2110–2170 <u>Downlink</u>					
UMTS1900	BC2			1850–1910 <u>Uplink</u>	1930–1990 <u>Downlink</u>						
UMTS1800	BC3	1710–1785 <u>Uplink</u>	1805–1880 <u>Downlink</u>								
AWS	BC4	1710–1755 <u>Uplink</u>				2110–2155 <u>Downlink</u>					
UMTS2600	BC7									2500–2570 <u>Uplink</u>	2620–2690 <u>Downlink</u>
UMTS1700	BC9	1750–1785 <u>Uplink</u>	1845–1880 <u>Downlink</u>								

UMTS Spectrum is Expanding





UMTS 900

- **3G License coverage obligations**

- Including rural coverage requirements

- **Indoor coverage in Urban areas**

- Subscribers expect good indoor coverage

- **Traffic Growth**

- Demand for both voice and data continue to grow

- **Leverage Available Spectrum**

- Efficient use of available 900 MHz spectrum
- Option for operators without 3G spectrum

- **Ideal for Rural Coverage**

- 900MHz has better RF propagation
- More capacity with same no. of sites OR Less numbers of sites with same coverage/capacity than GSM900

- **Cost Effective Option for Urban Indoor coverage**

- Better in-door coverage
- Cost-effective than in-door sites

- **Higher capacity than GSM900**

- Supports future Voice and Data growth

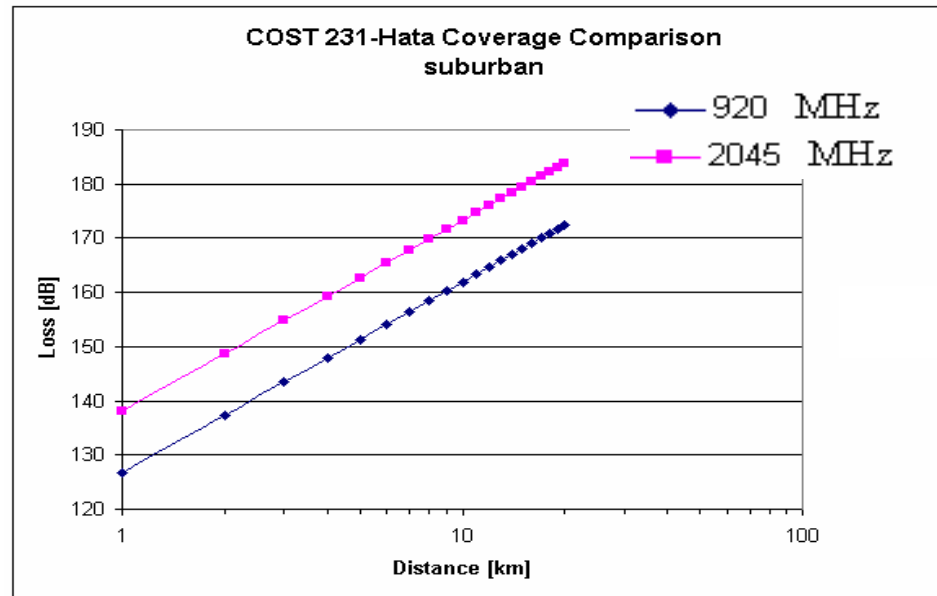
- **Provides homogenous network**

- Single network for both voice and data

- **Reduced CAPEX and OPEX**

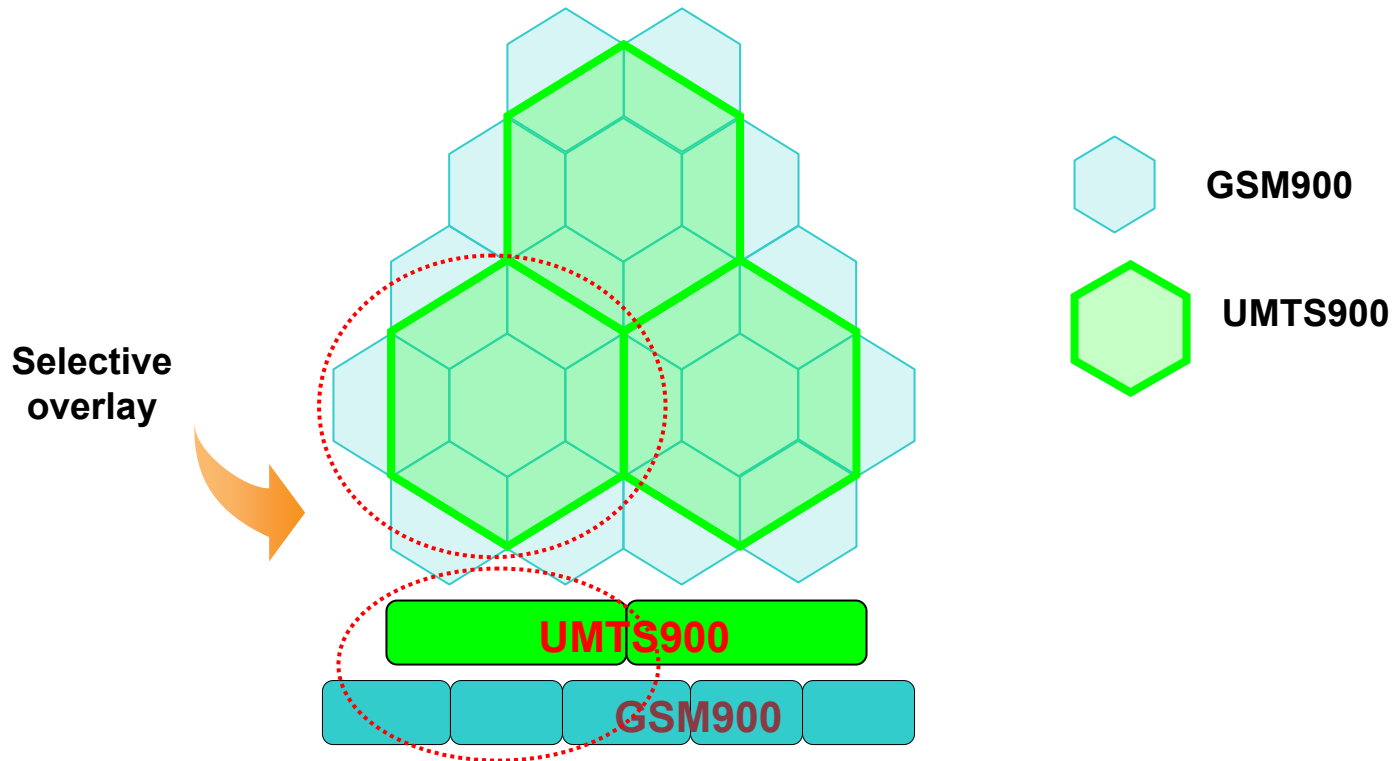
UMTS900 combines spectral efficiency of WCDMA with coverage benefits of 900 MHz band

- ***RF propagation of 900MHz signal is good in Rural and Suburban morphologies***
 - Cell radius of 900MHz site is more than double of that of 2.1GHz
- ***Better outdoor coverage of 900MHz band provides increased in-building penetration margin***



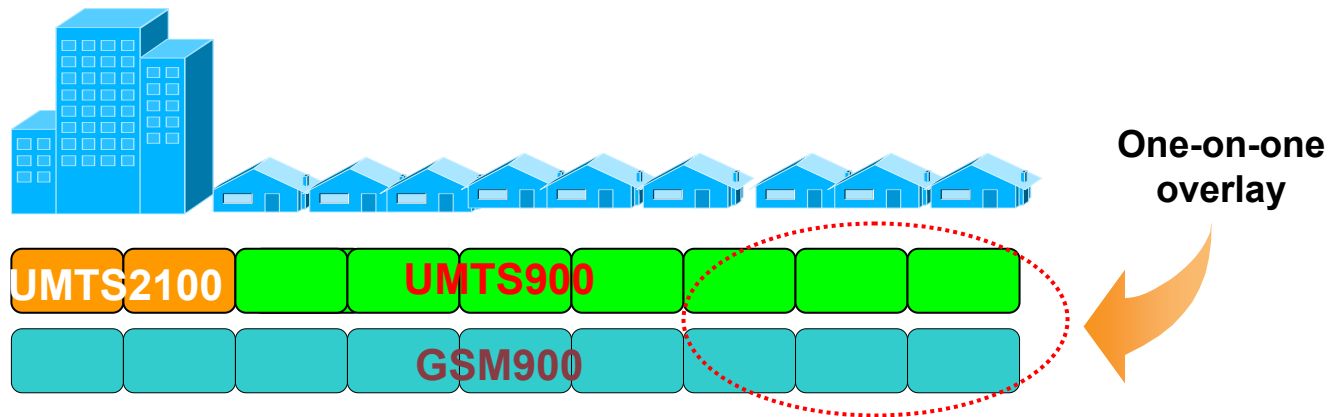
- ***UMTS900 Cell radius is about 50% greater than that of GSM900***
 - UMTS link budget is at least 6dB better than that of GSM

Provide efficient 3G voice and data coverage



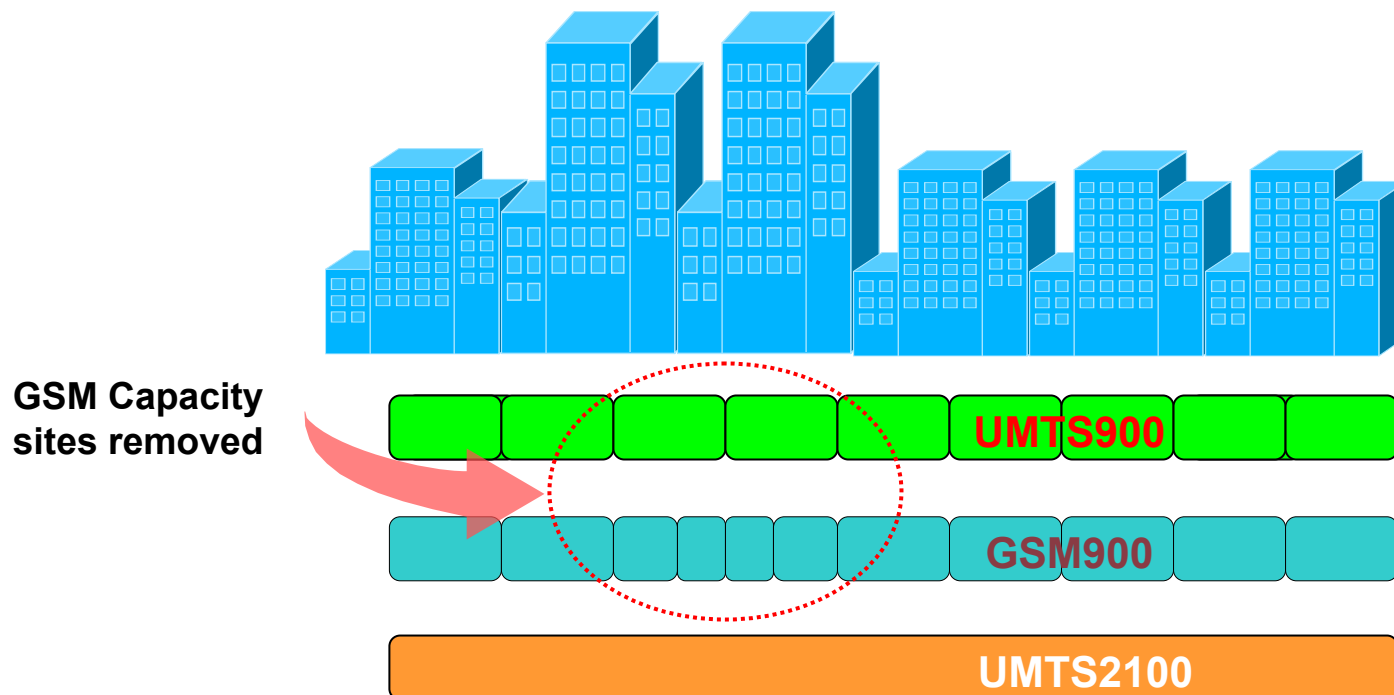
- ***Extend 3G coverage to rural areas***
- ***Low-cost solution - selective overlay (over GSM900)***
 - UMTS link budget is better than GSM providing similar coverage and capacity with less number of sites than GSM900

Provide full range of ubiquitous 3G services and augment capacity



- **Ubiquitous feature rich 3G services all across the network**
- **Easy deployment with One-on-one overlay (over GSM900)**
 - UMTS900 video service link budget is equal to that GSM900 voice
- **Cost efficient solution**
 - More capacity than GSM900 with same number of sites, less number of sites than 2100

Improve in-door coverage and augment capacity

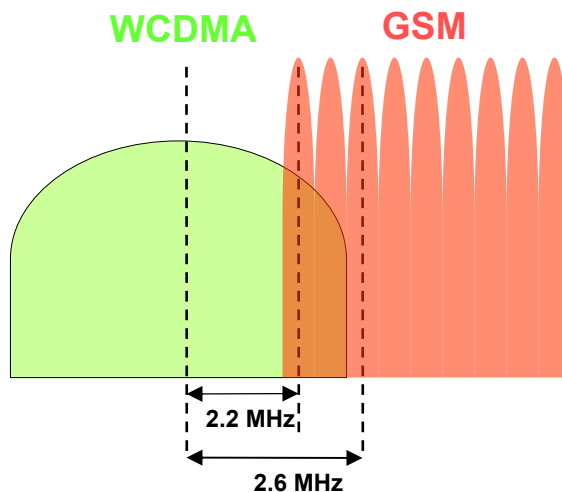


- *Improve indoor coverage, network performance and hence user experience*
- *Cost efficiently augment capacity*
 - More capacity than GSM
- *Eliminate GSM “capacity sites” in dense urban areas*

- ***UMTS900 can co-exist with GSM900***
- ***Two possible configurations based on deployment strategy***
 - “Coordinated” – UMTS900 and GSM900 are collocated
 - “Un-Coordinated” - UMTS900 and GSM900 are not collocated
- ***3GPP and CEPT have studied various co-existence scenarios and provided recommendations***
 - Coordinated
 - UMTS (macro) - GSM (macro), rural
 - Uncoordinated
 - UMTS (macro) - GSM (macro), urban
 - UMTS (macro) - GSM (macro), rural
 - UMTS (macro) - GSM (micro), urban
 - UMTS (macro) - GSM (pico), urban
- ***Operators can reduce interference through intelligent spectrum assignment frequency assignment and planning***

Coordinated Configuration

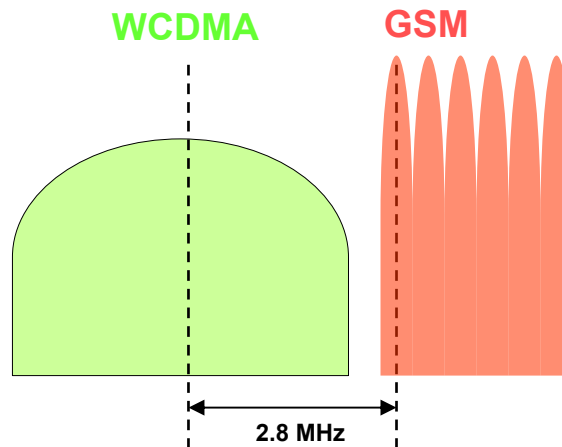
- **Carrier separation of 2.2 MHz or more is needed**
 - 3GPP estimates that a separation of 2.6MHz may be needed
 - Under worst case scenario - GSM/UMTS mutual interference only meets, but not exceed, 3GPP minimum performance requirements
 - 3GPP minimum performance specs are purposely relaxed to allow product differentiation on performance vs. cost.
 - Qualcomm’s studies show that even with 2.2MHz of separation the capacity loss is limited to 5% for UMTS (Macro) – GSM (Macro) coordinated scenario



Sources: 1. Compatibility Study for UMTS Operating within the GSM 900 and GSM 1800 bands – ECC/CEPT
 2. Paper titled “Frequency coordination between UMTS and GSM systems at 900 MHz” submitted by Qualcomm and Huawei to 8th Annual IEEE International Symposium (PIMRC '07)

Uncoordinated Configuration

- **Carrier separation of 2.8 MHz or more is needed**
 - 3GPP recommends 2.8 MHz or more of separation for negligible capacity loss for all Uncoordinated scenarios
- **Un-coordinate scenario might be unavoidable in Urban areas**
 - GSM900 Micro/Pico Cells and “Capacity Sites” may not be overlaid because of higher capacity provided by UMTS900

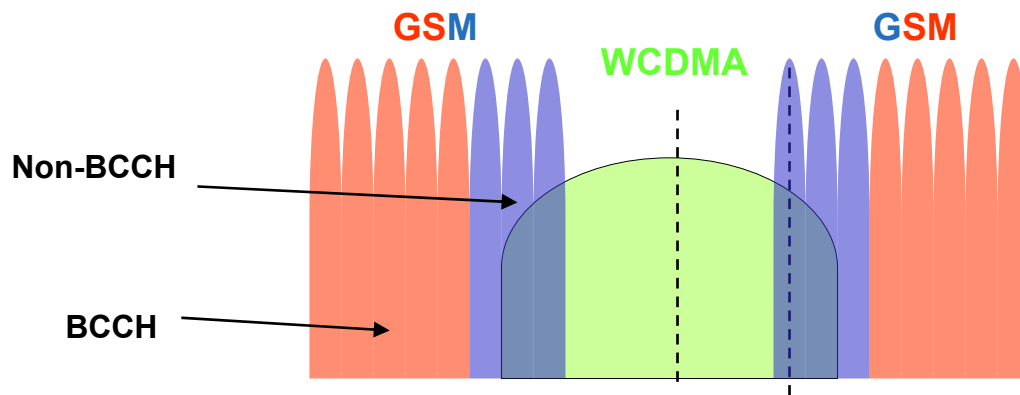


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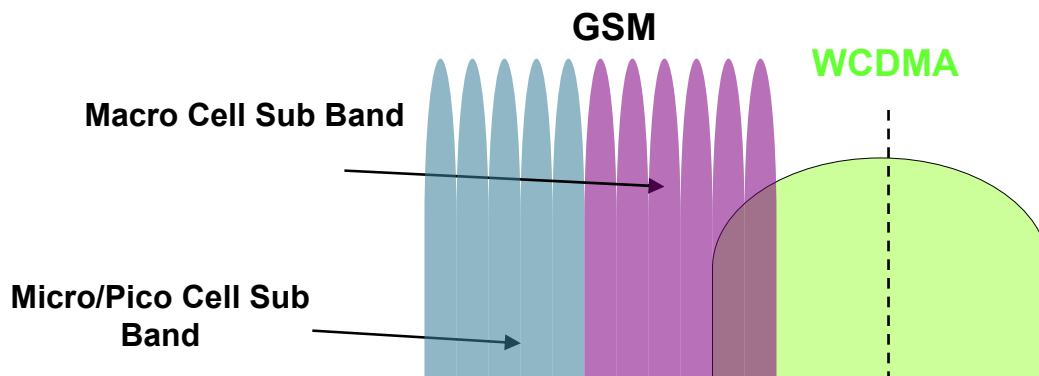
Interference Minimizing Techniques

Operators can employ few techniques to minimize interference

- *“Sandwich” type spectrum assignment to reduce interference between operators*
- *Assign Non-BCCH carriers to frequencies next to UMTS spectrum*



- *Deploy Macro cell sub-band between UMTS and Micro/Pico cell sub-band to reduce impact on GSM Micro/Pico cells*



- ***Spectrum Refarming***

- Some of refarming techniques – Incentivising upgrades, early seeding, limiting new GSM additions etc.
- Trading spectrum to get contiguous 5 MHz

- ***Network deployment strategy***

- Separate/Combined Infrastructure/BTS/Antenna systems
- Clear network access strategy
 - UMTS900 <-> UMTS2100
- Optimized mobility
 - Limited transitions between technologies (UMTS/GSM)
 - Limited transition between bands/networks (UMTS900/UMTS2100/GSM)

UMTS900 has Broad Industry Support

Standards



Operators



Vendors



Regulators



Standardization

- *GSM900 bands are identified by ITU-R as part of IMT-2000 family*
- *3GPP and ETSI have approved UMTS900 Technical Specifications*
- *3GPP and CEPT (ECC) have provided recommendations for UMTS900/GSM900 collocation*
- *GSMA has formed a group (SMG) to co-ordinate harmonization of UMTS spectrum across the world*

Regulators

- *There is significant support for UMTS900 from ECC member countries*
 - ECC issued decision designating GSM900 bands for IMT-2000 in Dec 2006
 - Finland and Belgium, and Portugal are the first countries to adopt ECC decision
 - **France**
 - UMTS900 licenses awarded in 2006
 - **Switzerland**
 - ComCom (regulator) authorized use of UMTS in 900MHz spectrum in March 2007
 - **Spain**
 - Regulatory approval expected in 2007 and commercial in 2008
 - **UK**
 - Auctions expected in 2H07
 - Others to follow soon – **Germany, Ireland, Romania, Netherlands**
- *United States, Australia, and New Zealand allows UMTS900 (850MHz spectrum is technology agnostic)*



Vodafone Portugal made the first 3G/UMTS voice, videocall and data calls in the 900 MHz frequency band in Portugal in Dec 2006. Indicated that as soon as it is possible in technical and regulatory terms, they intend to use UMTS 900 technology on its 3G/UMTS network expansion.



Manx (O2 subsidiary) and ALU announced successful completion of their first UMTS900 deployment (Trial) in March 2007

"UMTS 900 may help solve the 3G coverage issues in Europe, ... we hope to demonstrate how UMTS 900 can complement deployments at 2100 MHz, improve coverage, lower capital expenses and improve the customer's experience." - Dave Williams, CTO



"UMTS in the 900 MHz band is a complementary solution to existing 3G services that will enable Orange to provide high speed wireless Internet to both rural and urban areas of our different geographies," - Vivek Badrinath, EVP - Products, Technology and Innovation



"We are impressed by the voice quality of the call, and the HSDPA user data transfer speed reached our expectations. The WCDMA 900 MHz variant brings us an efficient solution, which could allow us to extend our 3G services to rural areas cost-effectively," says Paul Corbel, Chief Technical Officer, SFR.



Telstra has commercially launched UMTS network on 850MHz in Australia

- **Alcatel-Lucent**
 - ALU provided the systems for O2 (Manx) UMTS900 deployment/trial in UK
- **Nokia/Siemens**
 - Nokia's Flexi WCDMA BTS were used for SFR UMTS900 trials in France
- **Huawei**
 - Huawei technologies has completed video phone and HSDPA 3.6 Mbps services trials on a network in Europe and has indicated it plans to continue to conduct multiple UMTS900 MHz field trials in Australia and Europe.
- **Nortel**
 - Vodafone –Spain's UMTS900 trial used Nortel Infrastructure
- **Ericsson**
 - Telstra's commercial UMTS network (850 MHz) uses Ericsson's infrastructure
- **Qualcomm**
 - All of Qualcomm's UMTS chip sets will support UMTS900 from 2007

Most of the major UMTS infrastructure and device vendors support UMTS900

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